

AMENDMENTS TO CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

1. (Currently amended) A process for the catalytic selective oxidation of a sulfur compound contained in a hydrocarbonaceous feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, wherein the process comprises: contacting a gaseous feed mixture of the hydrocarbonaceous feedstock, of which the sulfur compound is selected from the group consisting of hydrogen sulfide, mercaptans, disulfides, and heterocyclic sulfur compounds, and a molecular-oxygen containing gas with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active mixture of rhodium, iridium, zirconium and cerium group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a catalyst carrier comprising zirconia that is stabilized or partially stabilized with yttria, wherein said feed mixture has an oxygen-to-carbon ratio of below 0.15.
2. (Original) The process of claim 1 wherein the oxygen-to-carbon ratio of the feed mixture is below 0.10.

Claims 3-8 (Canceled).

9. (Previously presented) The process of claim 2 wherein the temperature is maintained in the range of from 200 to 500°C.

Claim 10 (Canceled).

11. (Currently amended) The process of claim 1 wherein the catalyst carrier comprising zirconia that is partially stabilized or stabilized with yttria is coated with a zirconia paint

~~comprising zirconium oxide stabilized with CaO feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 10 bar (absolute).~~

12. (Original) The process of claim 11 wherein the feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 5 bar (absolute).

13. (Original) The process of claim 1 wherein the feed mixture is contacted with the catalyst at ambient pressure.

14. (Currently amended) The process of claim 1 wherein the hydrocarbonaceous feedstock is a gaseous hydrocarbonaceous feedstock containing heterocyclic sulfur compounds.

15. (Currently amended) The process of claim 14 wherein the hydrocarbonaceous feedstock is methane or natural gas and the heterocyclic sulfur compound is thiophene.

16. (Currently amended) The process of claim 46 [[14]] wherein said catalyst further consists essentially of a performance-enhancing inorganic metal cation selected from Al, Mg, Zr, Ti, La, Hf, Si, Ba, and Ce the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 10% v/v.

17. (Original) The process of claim 16 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 5% v/v.

18. (Original) The process of claim 15 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 10% v/v.

19. (Original) The process of claim 18 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 5% v/v.

20. (Original) The process of claim 1 wherein the feedstock is a liquid hydrocarbonaceous feedstock containing at most 1000 ppmw sulfur.

21. (Currently amended) A process for the catalytic selective oxidation of hydrogen sulfide contained in a methane or natural gas feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, wherein the process comprises: contacting a gaseous feed mixture of the methane or natural gas feedstock and a molecular-oxygen containing gas, wherein the gaseous feed mixture comprises up to 10% v/v hydrogen sulfide, with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active mixture of rhodium, zirconium and cerium group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a refractory oxide comprising zirconia that is stabilized or partially stabilized with yttria, wherein said feed mixture has an oxygen-to-carbon ratio of below 0.15.

Claims 22-23 (Canceled).

24. (Currently amended) The process of claim 21 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 5% v/v and said feed mixture has an oxygen-to-carbon ratio of below 0.10.

25. (Currently amended) A process for the desulfurization of a hydrocarbonaceous feedstock, wherein the process comprises: contacting a gaseous feed mixture of the hydrocarbonaceous feedstock, which contains a sulfur compound selected from the group consisting of hydrogen sulfide, mercaptans, disulfides, and heterocyclic sulfur compounds, and a molecular-oxygen containing gas with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a refractory oxide catalyst carrier comprising alumina stabilized with magnesium oxide zirconia that is partially stabilized or stabilized zirconia with yttria, wherein said gaseous feed mixture has an oxygen-to-carbon ratio of below 0.15, thereby selectively oxidizing the sulfur compounds in the hydrocarbonaceous

feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds to provide a gaseous product containing the thus-formed sulfur dioxide; and removing the thus-formed sulfur dioxide from said gaseous product by either solvent extraction using an aqueous amine solution or an alkaline solution, or by adsorption on copper, barium or cerium oxide, or by reaction with lime.

26. (Previously presented) The process of claim 25 wherein the oxygen-to-carbon ratio of the gaseous feed mixture is below 0.10.

Claims 27-29 (Canceled).

30. (Currently amended) The process of claim 26 wherein the sulfur compound which selectively oxidized to sulfur dioxide is a heterocyclic sulfur compound ~~oxygen to carbon ratio of the gaseous feed mixture is below 0.10.~~

Claims 31-32 (Canceled).

33. (Original) The process of claim 25 wherein the temperature is maintained in the range of from 200 to 500°C.

34. (Original) The process of claim 25 wherein the temperature is maintained in the range of from 200 to 300°C.

35. (Previously presented) The process of claim 25 wherein the gaseous feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 10 bar (absolute).

36. (Previously presented) The process of claim 35 wherein the gaseous feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 5 bar (absolute).

37. (Previously presented) The process of claim 25 wherein the gaseous feed mixture is contacted with the catalyst at ambient pressure.

38. (Currently amended) The process of claim 25 wherein the hydrocarbonaceous feedstock comprises heterocyclic sulfur compounds selected from the group consisting of thiophenes, benzothiophenes and dibenzothiophenes ~~is a gaseous hydrocarbonaceous feedstock.~~

39. (Original) The process of claim 38 wherein the hydrocarbonaceous feedstock is methane or natural gas.

40. (Original) The process of claim 38 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 10% v/v.

41. (Original) The process of claim 40 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 5% v/v.

42. (Original) The process of claim 39 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 10% v/v.

43. (Original) The process of claim 42 wherein the hydrocarbonaceous feedstock comprises hydrogen sulfide in a concentration of at most 5% v/v.

44. (Original) The process of claim 25 wherein the feedstock is a liquid hydrocarbonaceous feedstock containing at most 1000 ppmw sulfur.

45. (Currently amended) A process for the catalytic selective oxidation of a sulfur compound contained in a hydrocarbonaceous feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, wherein the process comprises: contacting a gaseous feed mixture of the hydrocarbonaceous feedstock, of which the sulfur compound is selected from the group consisting of hydrogen sulfide, mercaptans, disulfides, and heterocyclic sulfur compounds, and a molecular-oxygen containing gas with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active ~~mixture of rhodium, iridium, zirconium and cerium group VIII noble metal selected from the group~~

~~eonsisting of platinum, rhodium, iridium, and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, zirconium and cerium, supported on a catalyst carrier comprising zirconia that is stabilized or partially stabilized with yttria, wherein said feed mixture has an oxygen-to-carbon ratio of below 0.15.~~

46. (Currently amended) A process for the catalytic selective oxidation of a sulfur compound contained in a hydrocarbonaceous feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, wherein the process comprises: contacting a gaseous feed mixture of the hydrocarbonaceous feedstock, of which the sulfur compound is selected from the group consisting of hydrogen sulfide, mercaptans, disulfides, and heterocyclic sulfur compounds, and a molecular-oxygen containing gas with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium, and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a catalyst carrier comprising a non-refractory oxide bulk material having an oxidizing surface layer selected from the group consisting of alumina or zirconia, wherein said gaseous feed mixture has an oxygen-to-carbon ratio of below 0.15.

47. (Previously presented) A process as recited in claim 46, wherein the temperature is maintained in the range of from 200 to 500 °C; the feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 5 bar (absolute).

48. (Currently amended) A process for the catalytic selective oxidation of hydrogen sulfide contained in a methane or natural gas feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, wherein the process comprises: contacting a gaseous feed mixture of the methane or natural gas feedstock and a molecular-oxygen containing gas, wherein the gaseous feed mixture comprises up to 10% v/v hydrogen sulfide, with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active mixture of iridium, zirconium and cerium group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two

~~or more thereof~~ at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, ~~zirconium and cerium~~, supported on a refractory oxide comprising zirconia that is stabilized or partially stabilized with yttria, wherein said feed mixture has an oxygen-to-carbon ratio of below 0.15.

49. (Currently amended) A process for the catalytic selective oxidation of hydrogen sulfide contained in a methane or natural gas feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds, wherein the process comprises: contacting a gaseous feed mixture of the methane or natural gas feedstock and a molecular-oxygen containing gas, wherein the gaseous feed mixture comprises up to 10% v/v hydrogen sulfide, with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on catalyst carrier comprising a non-refractory oxide bulk material having an oxidizing surface layer selected from the group consisting of alumina or zirconia, wherein said gaseous feed mixture has an oxygen-to-carbon ratio of below 0.15.

50. (Previously presented) A process as recited in claim 49, wherein the temperature is maintained in the range of from 200 to 500 °C; the feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 5 bar (absolute).

51. (Currently amended) A process for the desulfurization of a hydrocarbonaceous feedstock, wherein the process comprises: contacting a gaseous feed mixture of the hydrocarbonaceous feedstock, which contains a sulfur compound selected from the group consisting of hydrogen sulfide, mercaptans, disulfides, and heterocyclic sulfur compounds, and a molecular-oxygen containing gas with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active mixture of rhodium, iridium, zirconium and cerium group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the

catalyst, ~~zirconium and cerium~~ supported on a refractory oxide catalyst carrier comprising zirconia that is partially stabilized or stabilized ~~zirconia~~ with yttria, wherein said gaseous feed mixture has an oxygen-to-carbon ratio of below 0.15, thereby selectively oxidizing the sulfur compound in the hydrocarbonaceous feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds to provide a gaseous product containing the thus-formed sulfur dioxide; and removing the thus-formed sulfur dioxide from said gaseous product by either solvent extraction using an aqueous amine solution or an alkaline solution, or by adsorption on copper, barium or cerium oxide, or by reaction with lime.

52. (Currently amended) A process for the desulfurization of a hydrocarbonaceous feedstock, wherein the process comprises:
contacting a gaseous feed mixture of the hydrocarbonaceous feedstock, which contains a sulfur compound selected from the group consisting of hydrogen sulfide, mercaptans, disulfides, and heterocyclic sulfur compounds, and a molecular-oxygen containing gas with a catalyst at a temperature of at most 500 °C, wherein said catalyst consists essentially of a catalytically active group VIII noble metal selected from the group consisting of platinum, rhodium, iridium and combinations of two or more thereof at a concentration in the range of from 0.02 to 10% by weight, based on the total weight of the catalyst, supported on a catalyst carrier comprising a non-refractory oxide bulk material having an oxidizing surface layer selected from the group consisting of alumina or zirconia, wherein said gaseous feed mixture has an oxygen-to-carbon ratio of below 0.15, thereby selectively oxidizing the sulfur compound in the hydrocarbonaceous feedstock to sulfur dioxide with no or minimal oxidation of the non-sulfur containing hydrocarbonaceous compounds to provide a gaseous product containing the thus-formed sulfur dioxide; and removing the thus-formed sulfur dioxide from said gaseous product by either solvent extraction using an aqueous amine solution or an alkaline solution, or by adsorption on copper, barium or cerium oxide, or by reaction with lime.

53. (Previously presented) A process as recited in claim 52, wherein the temperature is maintained in the range of from 200 to 500 °C; the feed mixture is contacted with the catalyst at a pressure in the range of from 1 to 5 bar (absolute).

Claims 54-64 (Withdrawn)

65. (Currently amended) A process as recited in claim 52 [[45]], wherein said catalyst further consists essentially of a performance-enhancing inorganic metal cation selected from Al, Mg, Zr, Ti, La, Hf, Si, Ba, and Ce.

66. (Previously presented) A process as recited in claim 65, wherein said concentration of said catalytically active group VIII noble metal is in the range of from 0.1 to 5% by weight.

67. (Previously presented) A process as recited in claim 66, wherein said temperature is maintained in the range of from 200 °C to 500 °C.

68. (Previously presented) A process as recited in claim 67, wherein said temperature is maintained in the range of form 200 °C to 300 °C.

69. (Previously presented) A process as recited in claim 68, wherein said oxygen-to-carbon ratio of said feed mixture is below 0.10.

70. (Previously presented) A process as recited in claim 47, wherein said non-refractory oxide bulk material is selected from a group of materials consisting of Fe, Cr and Al containing alloy with an alumina or zirconia surface layer.

71. (Previously presented) A process as recited in claim 70, wherein said concentration of said catalytically active group VIII noble metal is in the range of from 0.1 to 5% by weight.

72. (Previously presented) A process as recited in claim 71, wherein said temperature is maintained in the range of from 200 °C to 500 °C.

73. (Previously presented) A process as recited in claim 72, wherein said temperature is maintained in the range of form 200 °C to 300 °C.

74. (Previously presented) A process as recited in claim 73, wherein said oxygen-to-carbon ratio of said feed mixture is below 0.10.

75. (Currently amended) A process as recited in claim 49 [[48]], wherein said catalyst further consists essentially of a performance-enhancing inorganic metal cation selected from Al, Mg, Zr, Ti, La, Hf, Si, Ba, and Ce.

76. (Previously presented) A process as recited in claim 75, wherein said concentration of said catalytically active group VIII noble metal is in the range of from 0.1 to 5% by weight.

77. (Previously presented) A process as recited in claim 76, wherein said temperature is maintained in the range of from 200 °C to 500 °C.

78. (Previously presented) A process as recited in claim 77, wherein said temperature is maintained in the range of form 200 °C to 300 °C.

79. (Previously presented) A process as recited in claim 78, wherein said oxygen-to-carbon ratio of said feed mixture is below 0.10.

80. (Previously presented) A process as recited in claim 50, wherein said non-refractory oxide bulk material is selected from a group of materials consisting of Fe, Cr and Al containing alloy with an alumina or zirconia surface layer.

81. (Previously presented) A process as recited in claim 80, wherein said concentration of said catalytically active group VIII noble metal is in the range of from 0.1 to 5% by weight.

82. (Previously presented) A process as recited in claim 81, wherein said temperature is maintained in the range of from 200 °C to 500 °C.

83. (Previously presented) A process as recited in claim 82, wherein said temperature is maintained in the range of form 200 °C to 300 °C.

84. (Previously presented) A process as recited in claim 83, wherein said oxygen-to-carbon ratio of said feed mixture is below 0.10.

85. (Currently amended) A process as recited in claim 51, wherein the catalyst carrier comprising zirconia that is partially stabilized or stabilized with yttria is coated with a zirconia paint comprising zirconium oxide stabilized with CaO ~~said catalyst further consists essentially of a performance enhancing inorganic metal cation selected from Al, Mg, Zr, Ti, La, Hf, Si, Ba, and Ce.~~

86. (Currently amended) A process as recited in claim 85, wherein said concentration of said catalytically active mixture of metals group VIII noble metal is in the range of from 0.1 to 5% by weight.

87. (Previously presented) A process as recited in claim 86, wherein said temperature is maintained in the range of from 200 °C to 500 °C.

88. (Previously presented) A process as recited in claim 87, wherein said temperature is maintained in the range of form 200 °C to 300 °C.

89. (Previously presented) A process as recited in claim 88, wherein said oxygen-to-carbon ratio of said feed mixture is below 0.10.

90. (Previously presented) A process as recited in claim 53, wherein said non-refractory oxide bulk material is selected from a group of materials consisting of Fe, Cr and Al containing alloy with an alumina or zirconia surface layer.

91. (Previously presented) A process as recited in claim 90, wherein said concentration of said catalytically active group VIII noble metal is in the range of from 0.1 to 5% by weight.

92. (Previously presented) A process as recited in claim 91, wherein said temperature is maintained in the range of from 200 °C to 500 °C.

93. (Previously presented) A process as recited in claim 92, wherein said temperature is maintained in the range of form 200 °C to 300 °C.

94. (Previously presented) A process as recited in claim 93, wherein said oxygen-to-carbon ratio of said feed mixture is below 0.10.